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The Status of Yellowtail Flounder in NAFO Division 4T in 1996

G Poirier, R Morin, and D Swain

Department of Fisheries and Oceans
Science Branch
Maritimes Region
Moncton, New Brunswick

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ABSTRACT

Southern Gulf of St. Lawrence groundfish surveys indicate that the abundance of yellowtail flounder in NAFO 4T is at a historically average value since 1985. Reported landings of yellowtail have been variable but for the last 2 years have been at a fairly high level compared to the mean since 1960. Information from the commercial landings has not been collected in a regular and systematic way for yellowtail. A survey near the Magdalen Islands indicates the possibility of a juvenile area there. More information from the fisheries and more effort on surveys may help fill in some of the gaps in our knowledge of yellowtail flounder in the southern Gulf.

RÉSUMÉ

Les relevés du poisson de fond du sud du golfe du Saint-Laurent montrent que l'abondance de la limande à queue jaune dans la division 4T de l'OPANO est à son niveau historique moyen depuis 1985. Les débarquements signalés de cette limande ont été variables, mais, au cours des deux dernières années, ils ont été relativement élevés comparativement à la moyenne depuis 1960. Des données sur les débarquements commerciaux n'ont pas été obtenues de façon régulière et systématique pour cette espèce. Un relevé effectué à proximité des îles de la Madeleine montre qu'une zone de juvéniles pourrait exister à cet endroit. Plus de renseignements sur les pêches et de meilleurs relevés pourraient combler certaines lacunes de nos connaissances de ce stock de limande à queue jaune.

Introduction

Yellowtail flounder range from southern Labrador to Chesapeake Bay (Scott and Scott, 1988). Yellowtail occur in inshore waters in the southern Gulf of St. Lawrence, but have never been under quota management, and not much is known of their biology or population dynamics. They are, however, of interest to fishers in localized regions of the Gulf, and DFO has been asked for information about yellowtail flounder in North Atlantic Fisheries Organization (NAFO) Division 4T. In particular, fishers from the Magdalen Islands (Canadian statistical unit area 4Tf (Figure 1)) have expressed interest in yellowtail flounder. This stock status report is produced in response to this interest.

Description of the fisheries

Landings

Commercial landings of yellowtail flounder in 4T have been variable since 1960, ranging from less than 10 tonnes in several years in both the 1960's and 1970's to approximately 400 tonnes in 1986 and 1987 (Figure 2, Table 1). No yellowtail landings were recorded for 4T for 1975. However, landings recorded as unspecified flatfish have been large in many years prior to 1985 (Table 1), and it may be that some of these unspecified flounders were in fact yellowtail. Landings in 1995 and 1996 were higher than the long term average, at approximately 200 tonnes.

Since 1985, yellowtail have been most consistenty fished in Canadian statistical unit area 4Tf, with large portions of the catch being taken from 4Tl and 4Tm (Figure 3, Table 2). Landings of yellowtail were recorded from other unit areas in 4T more sporadically from 1985 to 1996. Prior to 1992, large portions of the landings were not allocated to a unit area (i.e. recorded as 4Tu). Yellowtail are fished primarily with seine and trawl during the months May to October (Table 2). Although during the period from 1985 to 1996 otter trawls have, on occasion, taken more than seines, since 1994 seines have taken the largest part of the landings. Gillnets account for a small part of the yellowtail landings in all years.

Management Measures Relevent to the Yellowtail Fishery

There has not been a TAC on yellowtail flounder in 4T. The regulations in place for 1996 were as follows. In Northumberland Strait and the Magdalen Islands, the approved mesh size for mobile gear in yellowtail-directed fisheries was 130-mm square mesh in codends while in Chaleur Bay and Miscou Bank, it was 135-mm square. Mobile gear fisheries targeting American plaice and witch flounder were required to use a minimum mesh size of 155-mm square. Gillnets were required to have a minimum mesh size of 140 mm. Restrictions were also imposed on the minimum size of yellowtail flounder. Fisheries were closed when yellowtail less than 25 cm in length exceeded 15% by number of the total yellowtail flounder catch, based on at-sea sampling. Closures were also imposed when the bycatch of cod or white hake exceeded 10% of the weight of total catches in yellowtail flounder-directed fisheries. In 1995, special licenses for bait fishing were eliminated in the southern Gulf to reduce the catches of juvenile flatfish. Dockside monitoring recorded the length composition of landed catches, providing a means to detect discarding at sea.

In 1996, there was one fishery closure due to the capture of small (<25 cm) yellowtail.

Information from the Industry

During the 6 workshops that DFO scientists held with fishers from the 4T groundfish fisheries in the fall of 1996, one individual from the Magdalen Islands commented that the abundance of yellowtail seemed up a bit in 1996. In addition, it was noted that, near the Magdalelen Islands, yellowtail are not found in the same locations in the autumn as in the summer.

Of the 223 respondents in the end of season telephone survey of groundfish fishers in the southern Gulf of St Lawrence, two indicated that yellowtail was their main groundfish priority in 1996. These fishers were both from the Magdalen Islands, and said that the abundance of yellowtail, as well as the size of the fish, was about the same in 1996 as in 1995.

Fishery Data

Commercial Port Samples

Port samples of commercial landings of yellowtail have been irregularly collected since 1985. Large portions (months, areas, and/or gears) of the fishery have not not been represented in the samples (Tables 2,3). No yellowtail samples were collected from 1989 to 1991, in 1993, or in 1994, and only one sample was obtained in 1996. Before 1992, virtually none of the samples were taken from 4Tf landings, and in 1988, there were no trawl samples taken.

The available samples were used to derive length frequencies of landings for 6 years since 1985 (Figure 4), which, however, may not give an accurate representation of commercial removals. For example, the modal length from 1985 to 1988 was between 30 and 32 cm, but in 1992 it was 29 cm, and in 1995 it was 27 cm. The fact that no samples before 1992 were taken from 4Tf, and all samples since 1992 were from 4Tf, means the observed change in modal length over time may be an artifact of the sampling intensity.

Although there exists 1 aged sample in each of 1975 and 1982 (a total of 51 fish), no ages are availiable for yellowtail flounder fished in the Gulf of St. Lawrence in the period 1985 to 1996.

Observer Samples

In both 1995 and 1996, length frequency samples of yellowtail catches were collected at sea by the Observer Programme. Two catches were sampled in 1995, both from 4Tf in June; they both show bimodal length distributions, with modes at 26 cm and 28 cm (Figure 5). In 1996, samples of seine catches from 4Tf in May and June show a modal length of 27 cm, while samples of trawl catches from 4Tl in September show a modal length of 28 cm.

Sentinel Surveys

In 1994 a limited Sentinel Survey programme, consisting mainly of fishing off the northeast coast of New Brunswick and in Chaleur Bay was put in place. The programme was expanded in 1995, and then again in 1996. Maps of the distribution of yellowtail catches in these surveys show large numbers caught off the coast of New Brunswick in 1994 and 1995, and around the Magdalen Islands in 1996 (Figure 6). In 1996, yellowtail catches off the N.B. coast were very small compared with the two previous years, and there were some yellowtail caught northeast of North Port, P.E.I., where DFO surveys have not found yellowtail (Figure 11).

Length frequency samples of the Sentinel Survey catches were collected. Length frequency distributions of yellowtail caught in the 1996 survey show a modal length of 29 cm for gillnet catches and trawl catches using 145 mm mesh and and a modal length of 30 cm for trawl catches with a 58 mm liner (Figure 7). The length frequency of yellowtail landings in 4T for 1996 was calculated by

combining Observer and Sentinel Survey samples, weighted to the respective catches (Figure 8). This shows a modal length of 27 cm.

Research Surveys

Annual Groundfish Surveys

Since 1971, the Department of Fisheries and Oceans has conducted stratified random surveys of 4T groundfish each September. The stratification scheme is shown in Figure 9. From 1971 to 1985, the research vessel *E.E.Prince* was used with a Yankee 36 bottom trawl fishing in the daytime only; from 1986 to 1991, the *Lady Hammond*, with a Western IIA trawl was used for both day and night fishing; and since 1992, the *Alfred Needler*, with a Western IIA trawl has been used for 24 hour fishing. Experiments to compare the fishing power of the vessels were performed before each change in vessel.

Paired t-tests of log-transformed yellowtail catches showed that the *Lady Hammond* was significantly better at catching yellowtail than the *E.E.Prince*, but showed no difference in catches by the *Lady Hammond* and the *Alfred Needler* (Nielsen, 1994). Similar analysis of a comparative experiment in 1988 testing day versus night catches of groundfish in 4T showed that nighttime catches of yellowtail were significantly higher than daytime catches. To create an abundance index for yellowtail that is comparable for the period 1971 to 1996, therefore, research vessel catches were converted to their daytime *Alfred Needler* equivalents; numbers of fish caught by the *E.E. Prince* were divided by .673; numbers caught in night sets were multiplied by .323.

The mean number of yellowtail per standardized 1.75 nm tow shows low abundance (fewer than 10 yellowtail/tow) in the early 1970's, increasing to the early 1980's, and then decreasing somewhat to a stable level at about 20 yellowtail/tow since 1985 (Figure 10). A map showing the distribution of all yellowtail catches in the 4T survey shows that yellowtail in September are concentrated around the Magdalen Islands, along the north east coast of New Brunswick, along the north coast of Prince Edward Island and in St. Georges Bay, with lesser concentrations along the east coast of P.E.I. (Figure 11). Maps of individual surveys show that catches since 1992 have been large near the Magdalen Islands and along the N.B. and P.E.I. coasts (Figure 12).

To test the night to day conversion factor, mean numbers per tow for day sets, night sets, and combined day and night sets were calculated for 1985 to 1996 using only those strata with sets in both time periods in a survey. Night catches were converted to day catches using the .323 factor, and the resulting abundance indices are graphed in Figure 13. The abundance trends are not the same, in particular giving different perspectives for the period from 1990 to 1995. This may be a result of using a conversion factor calculated on the basis of one experiment, at one point in time. Some strata that are important for their yellowtail catches were sampled in only the night or only the day in several surveys. This is a potential problem, and something that should be taken into account, both in survey preparation and analysis.

The surveys were analyzed to give a separate index of abundance for the strata surrounding the Magdalen Islands, because of the apparent discreteness of this area, and the particular interest in yellowtail expressed by fishers from the Magdalens. Abundance trends for these do not give the same picture as for 4T as a whole (Figure 14). The abundance peaked earlier for the Magdalen Islands than in 4T as whole (1977 versus 1981), and has been generally increasing since 1985. The trend in the rest of the strata follows very close to the 4T trend; the large mean numbers/tow near the Magdalen Islands are basically overwhelmed by the smaller mean numbers/tow in the much greater area remaining in 4T.

Length frequencies of yellowtail in the survey are plotted in Figure 15. The modal length has varied between 26 cm and 29 cm for most years, with the mode in 1996 being 28 cm. It appears in several instances that year classes can be tracked from one year to the next (e.g. a mode at 16 cm in 1990, and one at 21 cm in 1991). While the range of length frequencies has not changed, the number of small fish (<10 cm) is larger in 1995 and 1996 than the previous 3 years.

Seasonal Surveys

In 1986 and 1987, six seasonal surveys were made in the eastern Gulf of St. Lawrence. The distribution of yellowtail caught in these surveys is shown in Figure 16. In December and January, there were few catches of yellowtail in the western part of the survey area between P.E.I. and mainland Nova Scotia, where yellowtail catches were common in September (Clay, 1991). As well, yellowtail in December were caught close to both the 4VN line and the Laurentian Channel, where few were caught in other months. Yellowtail are known to be relatively sedentary (Royce et al, 1959), but to migrate short distances from shallower waters in the summer to deeper, warmer waters in the winter (Scott and Scott,1988). The yellowtail found near the Magdalen Islands in September perhaps move towards the warmer channel water in winter. But the distance from the Northumberland Strait to the channel is rather longer than yellowtail are thought to migrate, and it is not known where they go in winter.

January Surveys

January surveys have been conducted each year since 1994 in the Cabot Strait and NAFO 4VN to determine groundfish winter distributions. In these surveys, yellowtail, although not common, are caught northeast of the Magdalen Islands towards the Laurentian Channel, and in water near the coast of Newfoundland (Figure 17). These results are consistent with those of the seasonal surveys.

Calanus Survey

A lobster research survey was conducted near the Magdalen Islands, by DFO staff from IML, in September, 1996. The survey area was close to the eastern shores of the Magdalen Islands - outside of the groundfish survey boundaries. Yellowtail flounder were present in every fishing set (Figure 18) and a large number of small yellowtail (<16 cm) were caught (Morin, 1997). This may indicate a nursery or juvenile area for yellowtail in the shallow water off the east coast of the Magdalen Islands. The 4T groundfish survey did not find large numbers of small yellowtail in the stratum bordering on the lobster survey area, suggesting that small fish are shoreward of the 4T survey coverage area.

Prognosis

Information from research surveys indicates that yellowtail flounder in 4T are at a stable abundance level since 1985. There is no indication from length frequency data that older fish are not as prevelant as they were in the past. The large number of small fish found very close to the Magdalen Islands may indicate that it is a juvenile area and that surveying these inshore waters may provide a useful recruitment index for this population.

Acknowledgements

The authors thank T. Hurlbut and A. Sinclair for their helpful comments and suggestions.

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Table 1. Recorded landings (tonnes) of yellowtail and unspecified flounders in NAFO 4T. Data for 1960 to 1992 are taken from NAFO files, data for 1993 to 1996 are from Statistics Branch files, and are preliminary.

Year	Yellowtail Flounder	Unspecified Flatfish
1960	2	2405
1961	7	2493
1962	2	1304
1963	51	0
1964	39	0
1965	51	0
1966	125	0
1967	55	0
1968	6	0
1969	243	0
1970	44	0
1971	5	0
1972	3	1201
1973	1	1388
1974	21	602
1975	0	2464
1976	29	668
1977	25	1163
1978	3	764
1979	52	841
1980	41	759
1981	10	118
1982	6	344
1983	26	792
1984	82	46
1985	215	3
1986	396	0
1987	404	0
1988	198	0
1989	43	36
1990	15	37
1991	54	37
1992	117	91
1993	36	0
1994	62	0
1995	208	0
1996	217	0
mean (1960-1996)	78.2	474.5

Table 2. Landings (kg) of yellowtail flounder in 4T, by unit area, month, and gear. All data from Statistics Branch files.

													mean
Unit area	85	86	87	88	89	90	91	92	93	94	95	96	85-96
4Tf	9324	113337	218604	148984	6160	14	35999	81589	3507	7266	148915	181591	79608
4Tg	3316	7883	8572	6613	402	3	5260	29	270	999	2021	3958	3277
4Th	91	0	0	0	0	0	228	0	1588	0	0	0	159
4Tj	0	10306	3932	13084	0	0	3909	2463	1582	0	0	73	2946
4Tk	0	0	0	0	0	0	0	0	0	2512	0	83	216
4Tl	9999	9131	64530	2153	12922	116	1311	2398	9942	46597	49876	29495	19873
4Tm	72891	28000	17282	0	0	45	0	27909	8269	3193	6724	1904	13851
4Tn	431	9599	726	674	0	116	703	4062	53	253	224	59	1408
4To	51	2752	325	837	0	0	0	0	0	0	0	28	333
4Tp	0	15	6468	100	0	0	0	0	324	759	288	0	663
4Tq	7	7	0	1412	0	0	0	0	0	0	0	0	119
4Tu	120896	219316	84059	30075	22526	15297	6210	499	10953	907	38	0	42565
Total	217006	400346	404498	203932	42010	15591	53620	118949	36488	62486	208086	217191	165017

													mean
Month	85	86	87	88	89	90	91	92	93	94	95	96	85-96
Jan	616	0	0	0	0	0	0	0	0	0	0	0	51
Apr	0	0	600	0	0	0	0	0	0	0	288	0	74
May	9185	9452	1265	119421	3818	0	0	136	0	759	43456	75255	21896
Jun	8878	14984	44342	17650	9064	150	0	61981	586	253	76985	72400	25606
July	21370	42917	83786	26006	10031	12661	1977	19774	6867	21627	38517	16446	25165
Aug	15836	74524	87858	7841	6144	582	1019	2756	7654	2722	23027	20827	20899
Sept	35223	86679	56775	10440	7203	1889	4594	26963	19799	25219	24548	16520	26321
Oct	53100	108885	109403	12383	5447	261	33446	6485	1582	11906	1265	15068	29936
Nov	72798	62144	20141	10169	303	48	12584	854	0	0	0	675	14976
Dec	0	761	328	22	0	0	0	0	0	0	0	0	93
Total	217006	400346	404498	203932	42010	15591	53620	118949	36488	62486	208086	217191	165017

													mean
Gear	85	86	87	88	89	90	91	92	93	94	95	96	85-96
Gillnet	15	466	14921	3421	587	153	906	524	377	1298	2345	76	2091
H-line	0	748	1056	0	0	45	21	0	0	0	0	1	156
L-line	55	5	2703	362	28	0	105	0	0	0	38	0	275
Miscl	2480	0	0	0	0	0	0	0	0	0	0	0	207
Seine	75334	296073	292846	53052	9811	2281	44680	11751	16619	37857	118570	181902	95065
Trawl	139122	103054	92972	147097	31584	13112	7908	106674	19492	23331	87133	35212	67224
Total	217006	400346	404498	203932	42010	15591	53620	118949	36488	62486	208086	217191	165017

Table 3. Summary of commercial yellowtail length frequency port samples

Year	May-June	July-October
1985		8 seine 1 trawl
1986	5 seine 3 trawl	12 seine 9 trawl
1987	9 seine 2 trawl	9 seine 3 trawl
1988	2 seine	4 seine
1992	3 seine 3 trawl	1 trawl
1995	1 seine 3 trawl	1 seine
1996	1 seine	

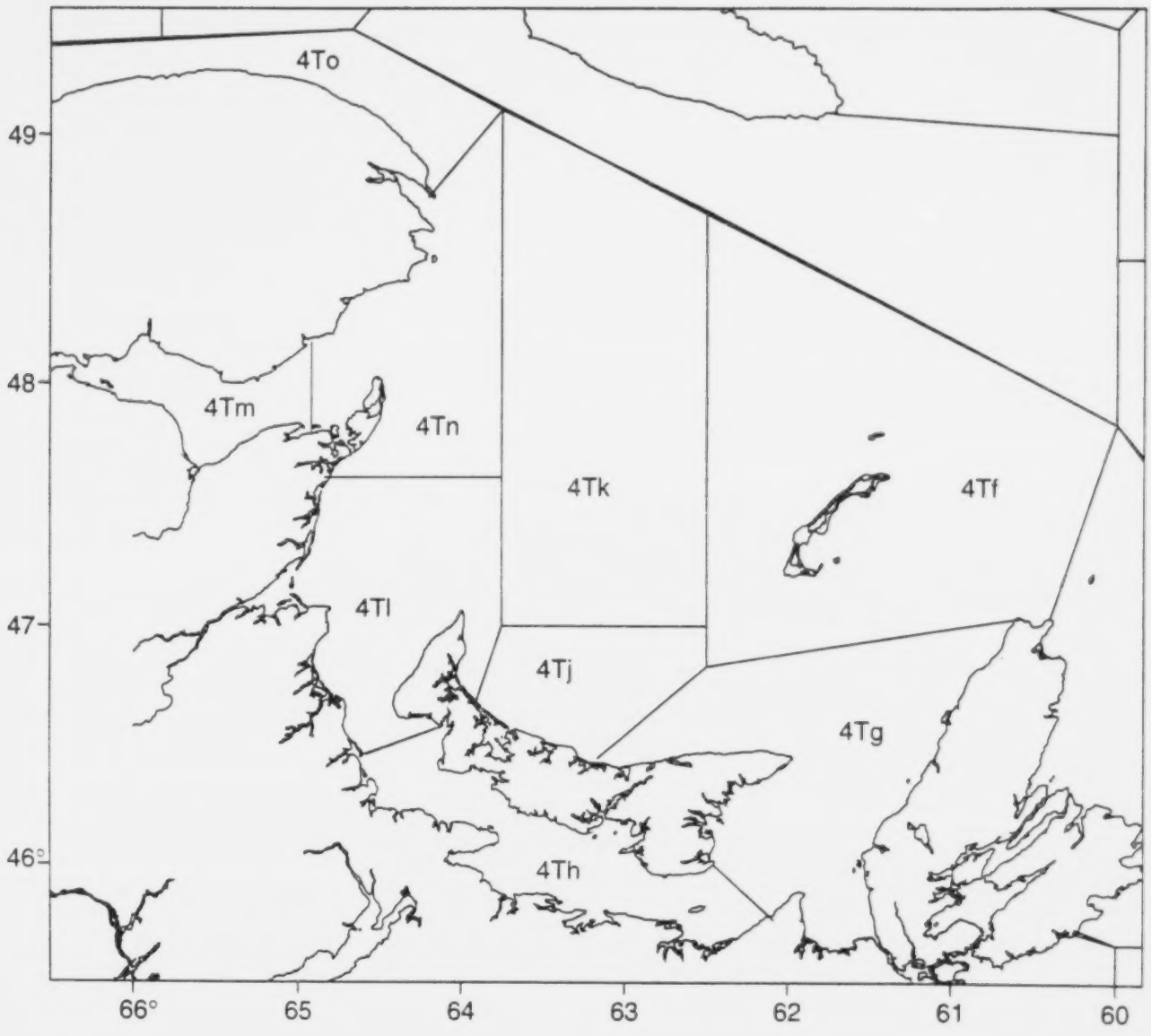


Figure 1. Canadian Statistical Unit Areas in NAFO 4T.

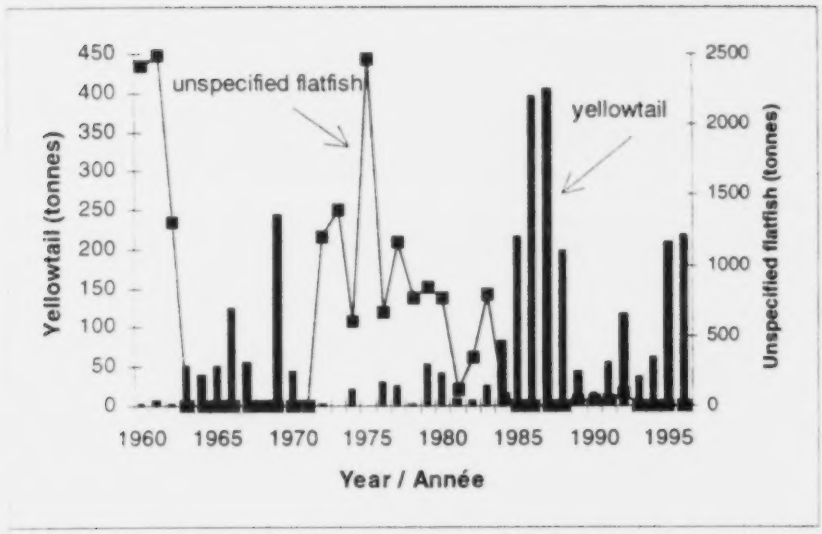


Figure 2. Landings of yellowtail anmd sunspecified flatfish in the southern Gulf of St. Lawrence, from 1960 to 1996.

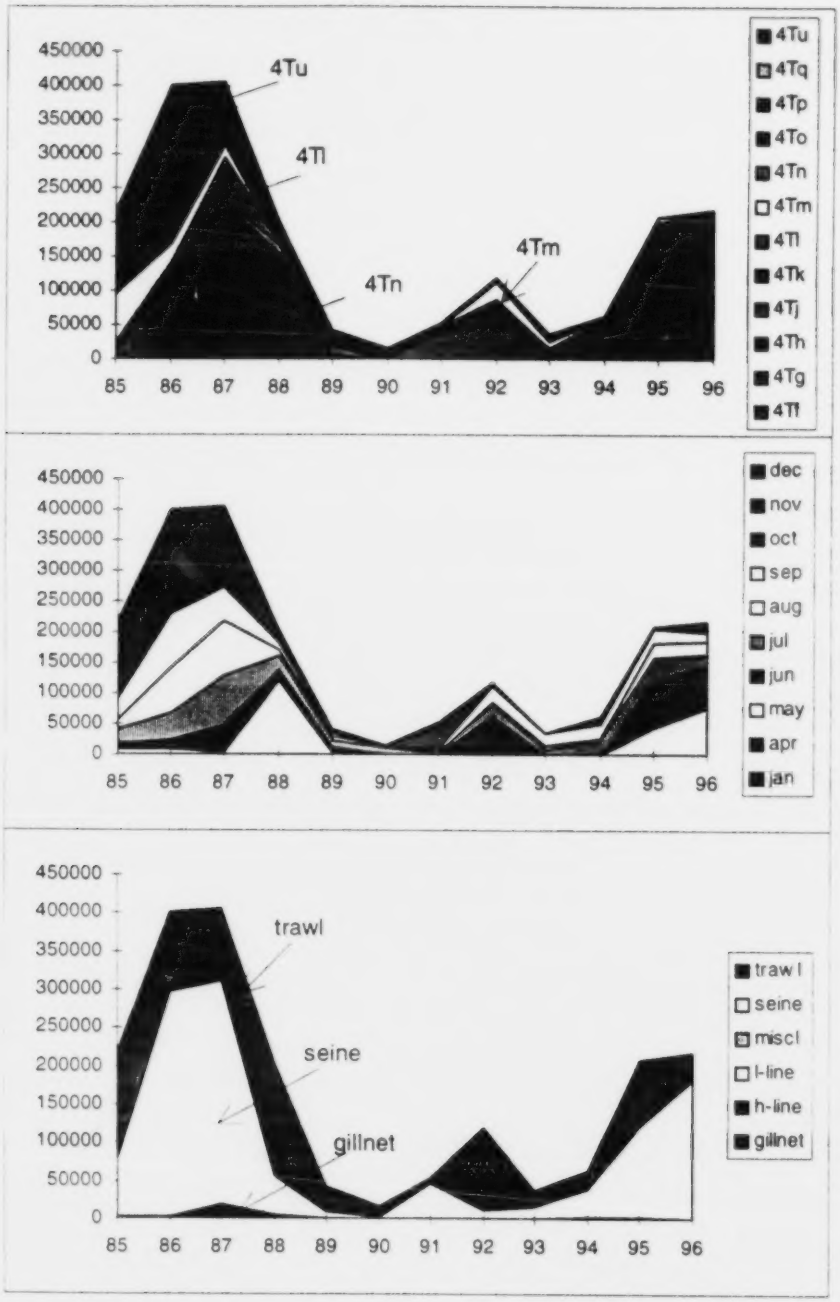


Figure 3. 4T Yellowtail landings by month, gear, and unit area.

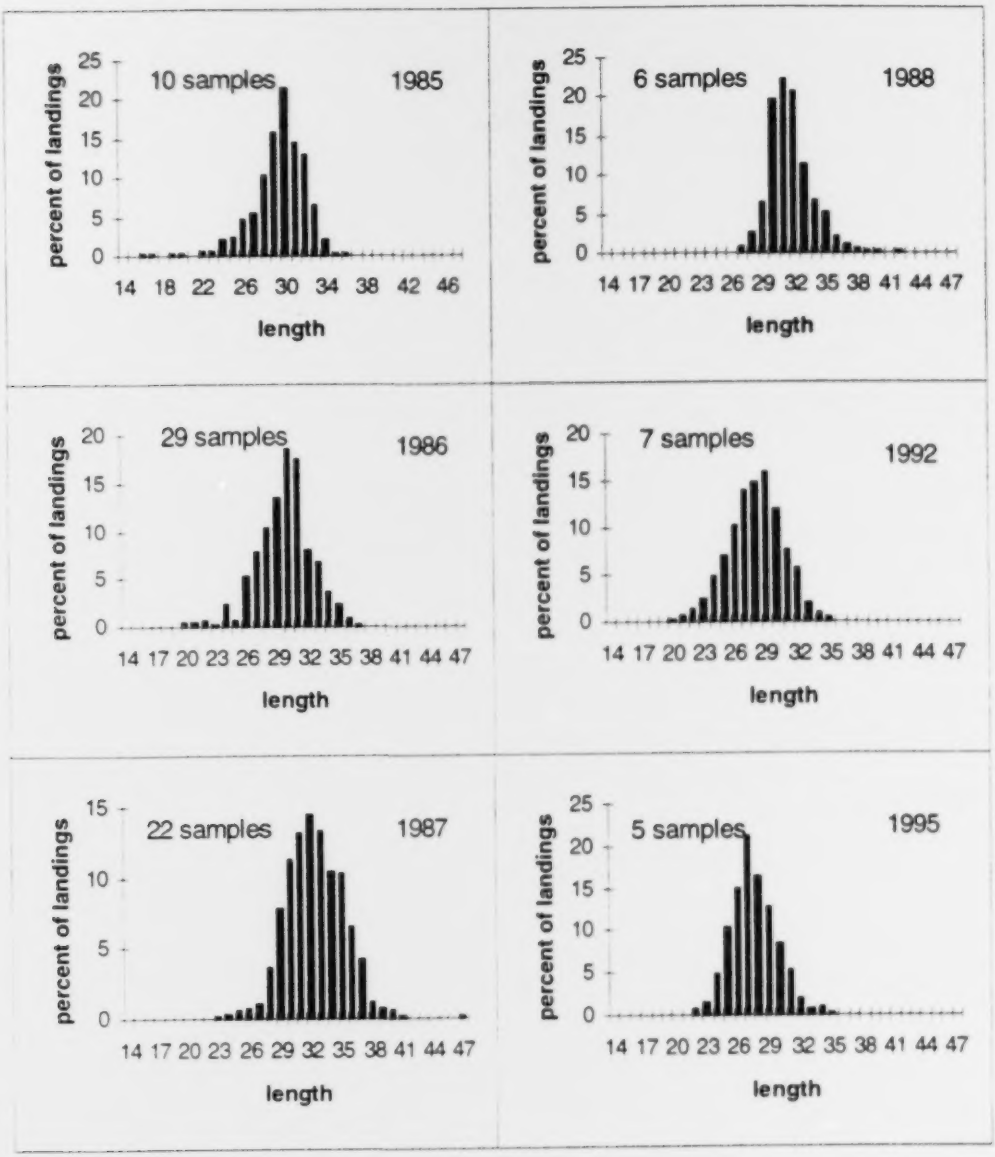
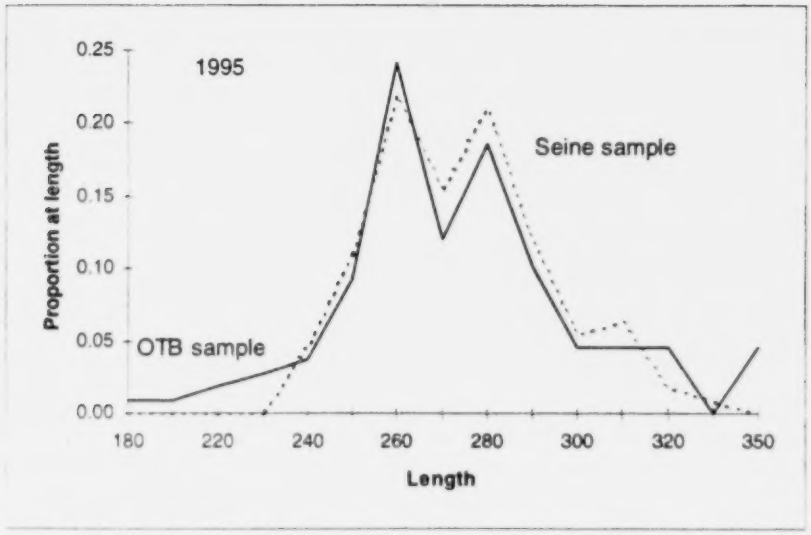
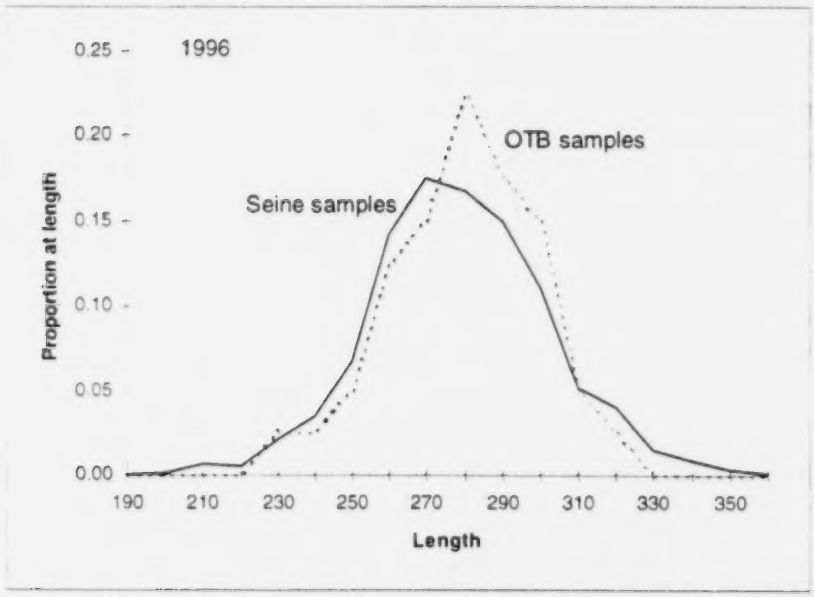


Figure 4. Length frequencies of 4T yellowtail landings.



1 trawl sample from 4Tf in June, mesh size 145 mm
1 seine sample from 4Tf in June, mesh size 135 mm



2 trawl samples from 4Tl in September, using 145 mm mesh
9 seine samples from 4Tf in May and June using 130mm mesh

Figure 5. Length frequencies of yellowtail Observer samples taken in 1995 and 1996.

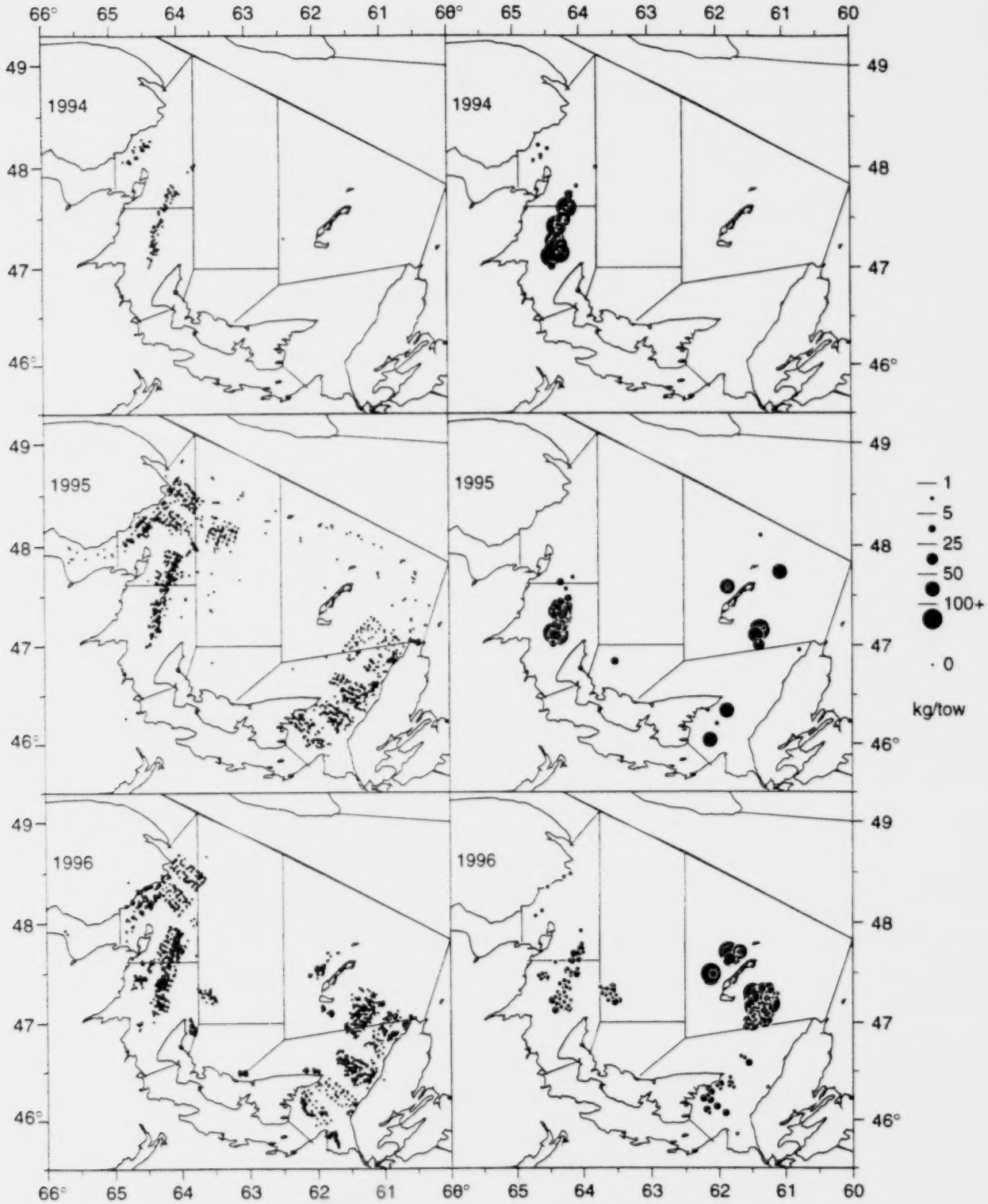


Figure 6. Location of sets (left panels) and yellowtail catches (right panels) in the 1994-1996 4T sentinel fisheries (all gears).

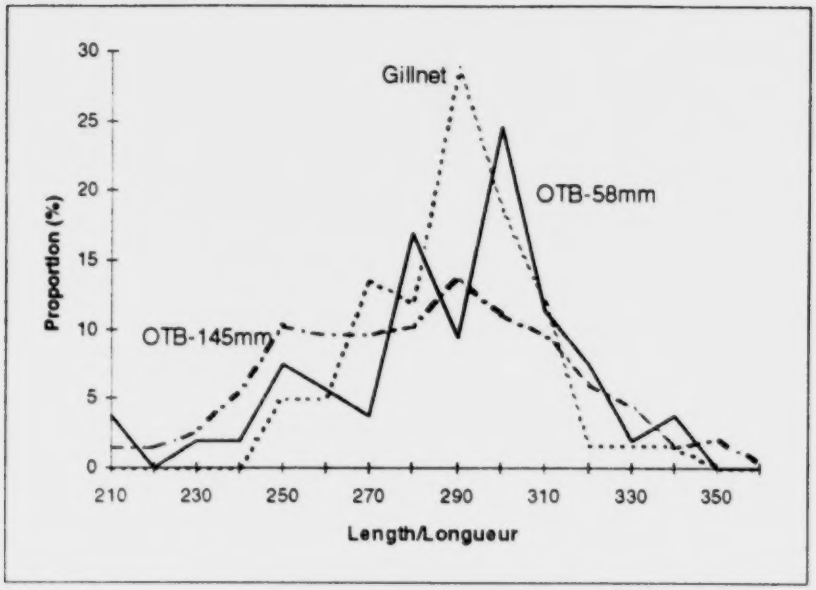


Figure 7. Length frequencies of yellowtail samples taken in the 1996 4T Sentinel fishery.
56 fish sampled from gillnet catches using 155mm mesh in 4Tl (Aug - Sept)
3 fish sampled from a gillnet catch using 140mm mesh in 4Tl (Oct)
197 fish sampled from a trawl catch using 145mm mesh in 4Tl (Sept)
53 fish sampled from a trawl catch using 58mm mesh in 4Tf (Oct)

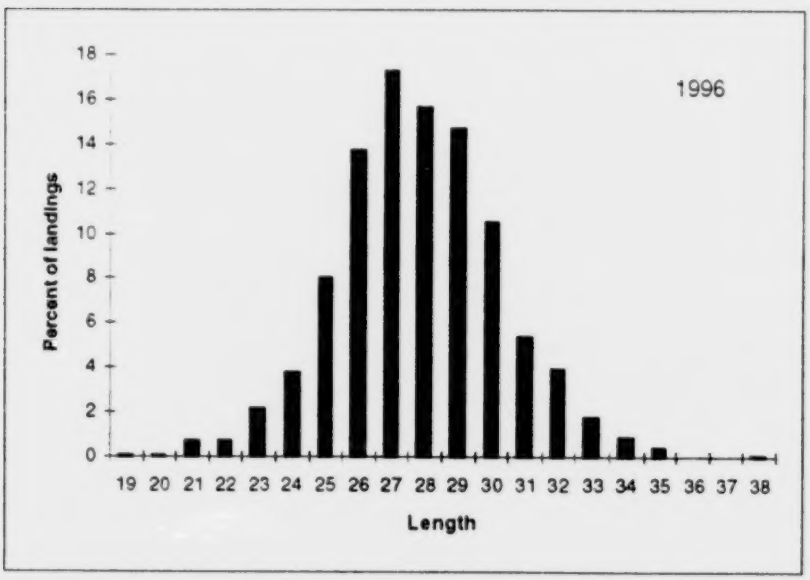


Figure 8. Length frequency of 1996 4T yellowtail landings, calculated from Observer and Sentinel fishery samples.

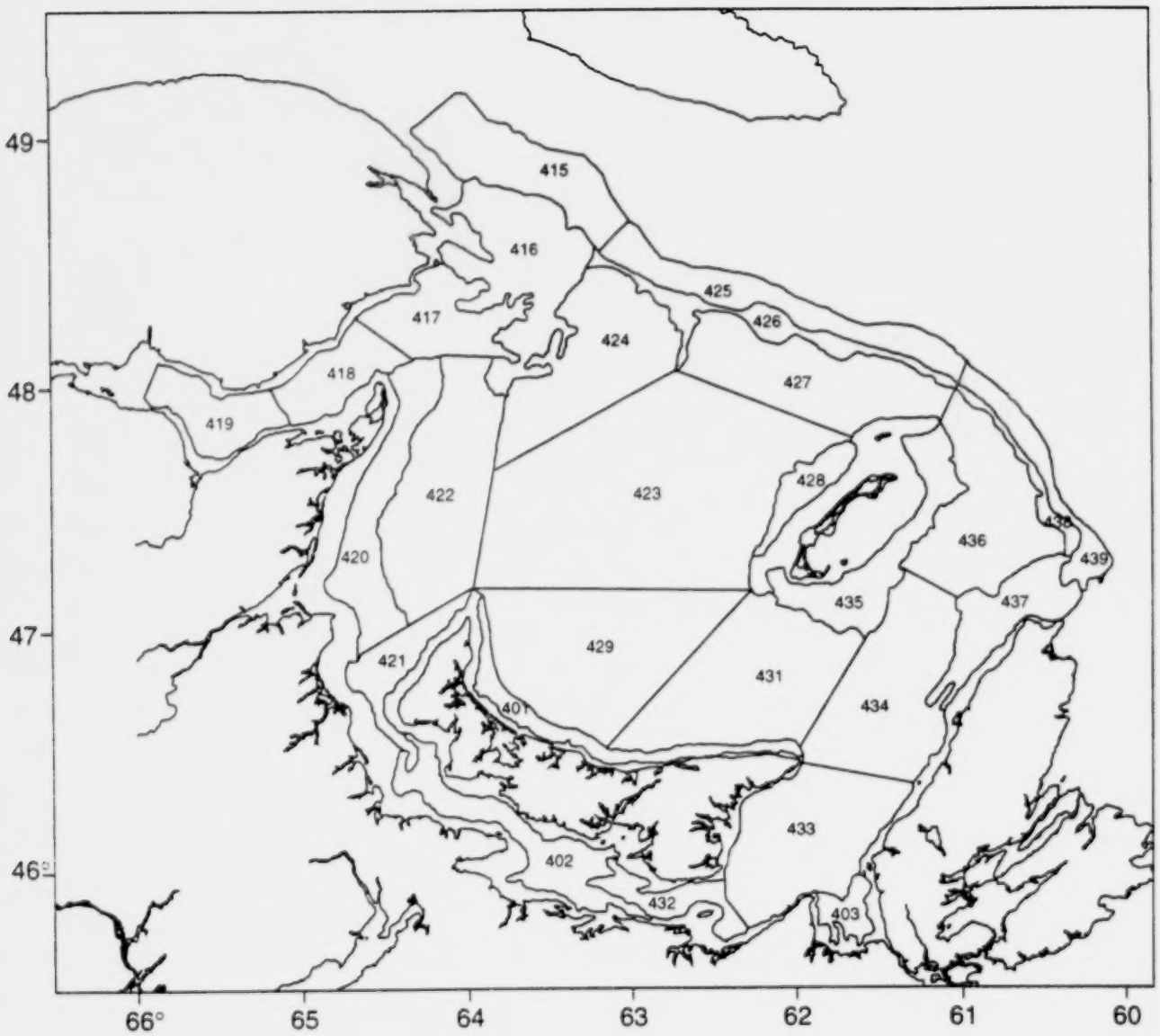


Figure 9. Stratification scheme used in the groundfish surveys in the southern Gulf of St. Lawrence.

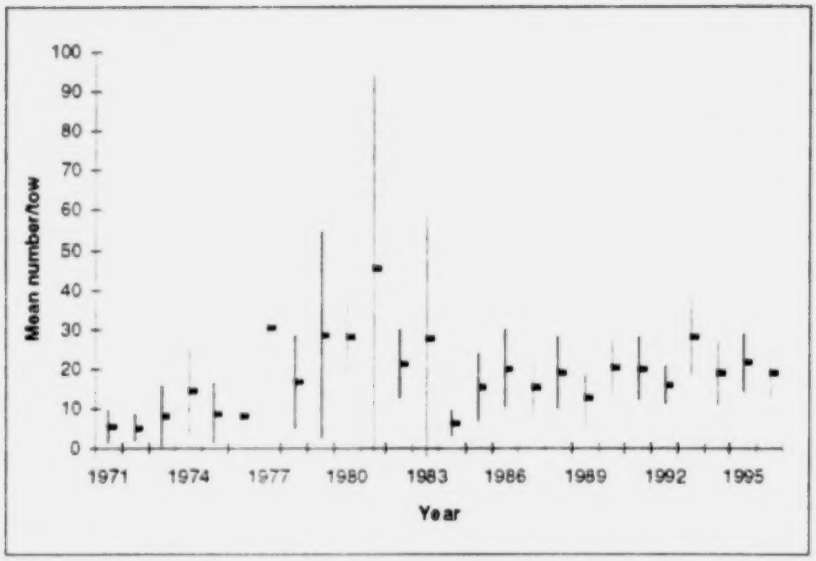


Figure 10. Mean number per tow for yellowtail in the southern Gulf of St. Lawrence September groundfish surveys. Error bars indicate approximate 95% confidence intervals.

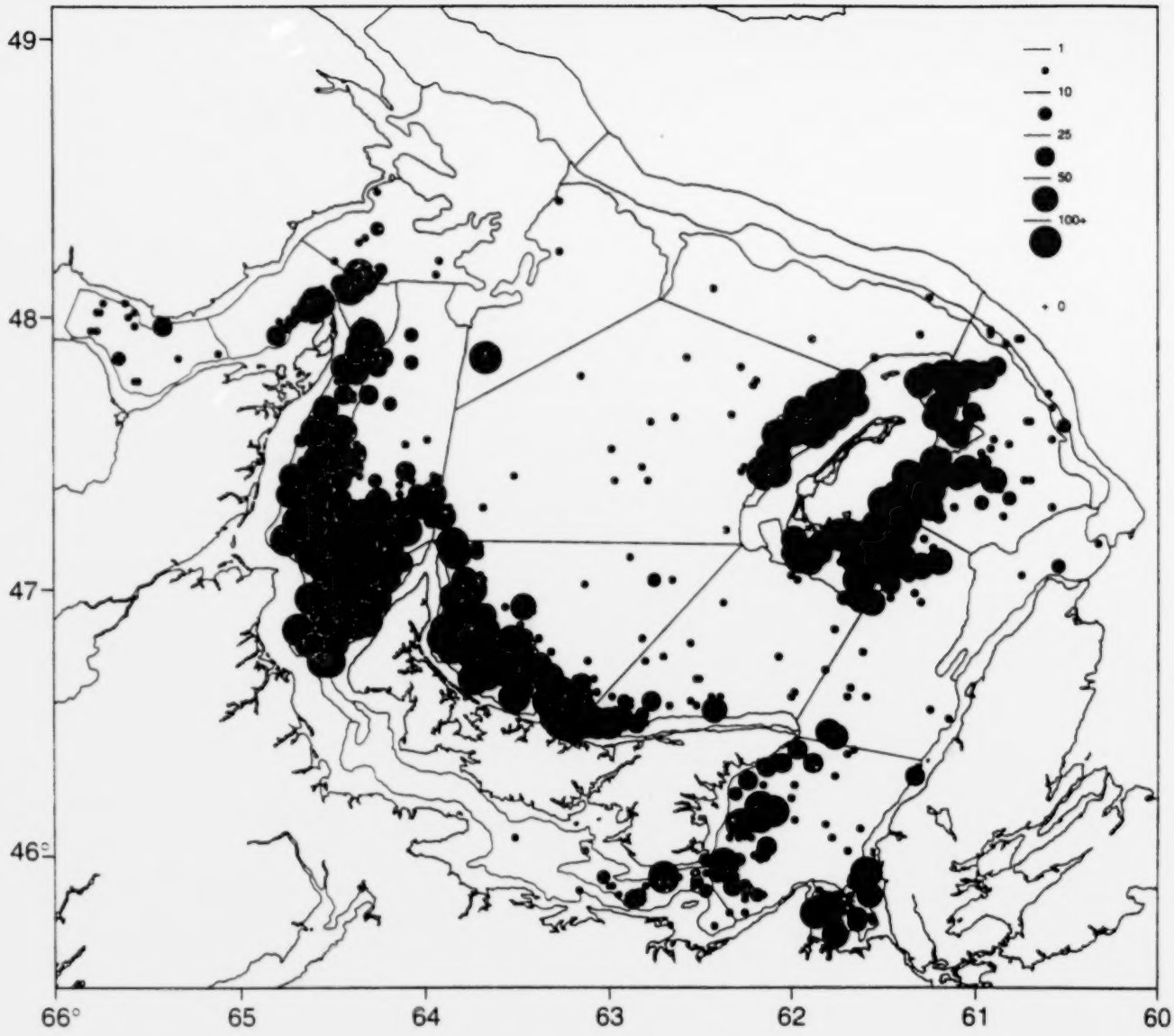


Figure 11. Yellowtail catches (numbers) in the southern Gulf of St. Lawrence groundfish surveys from 1971 to 1996

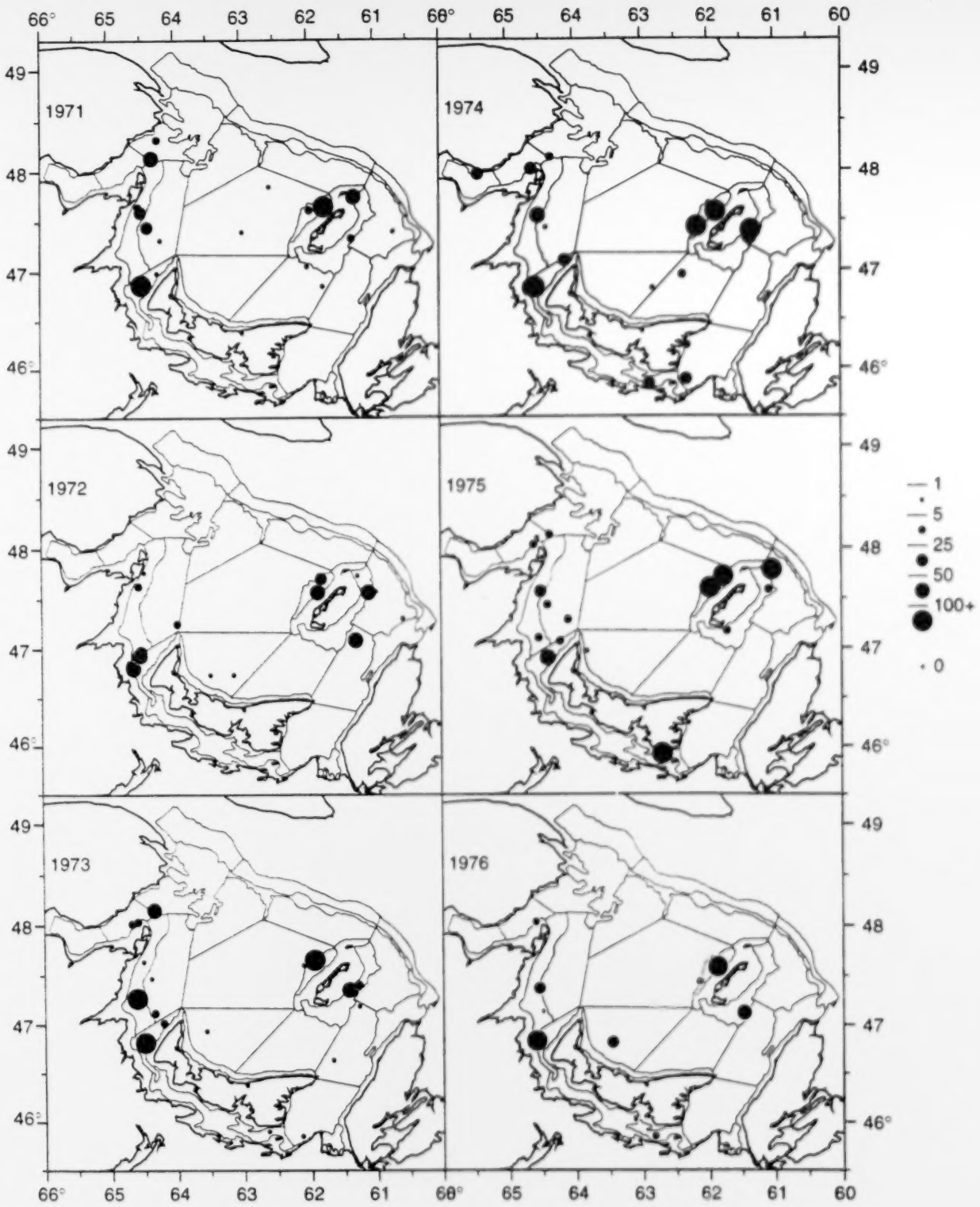


Figure 12. Location of yellowtail catches (numbers) during September surveys in the southern Gulf.

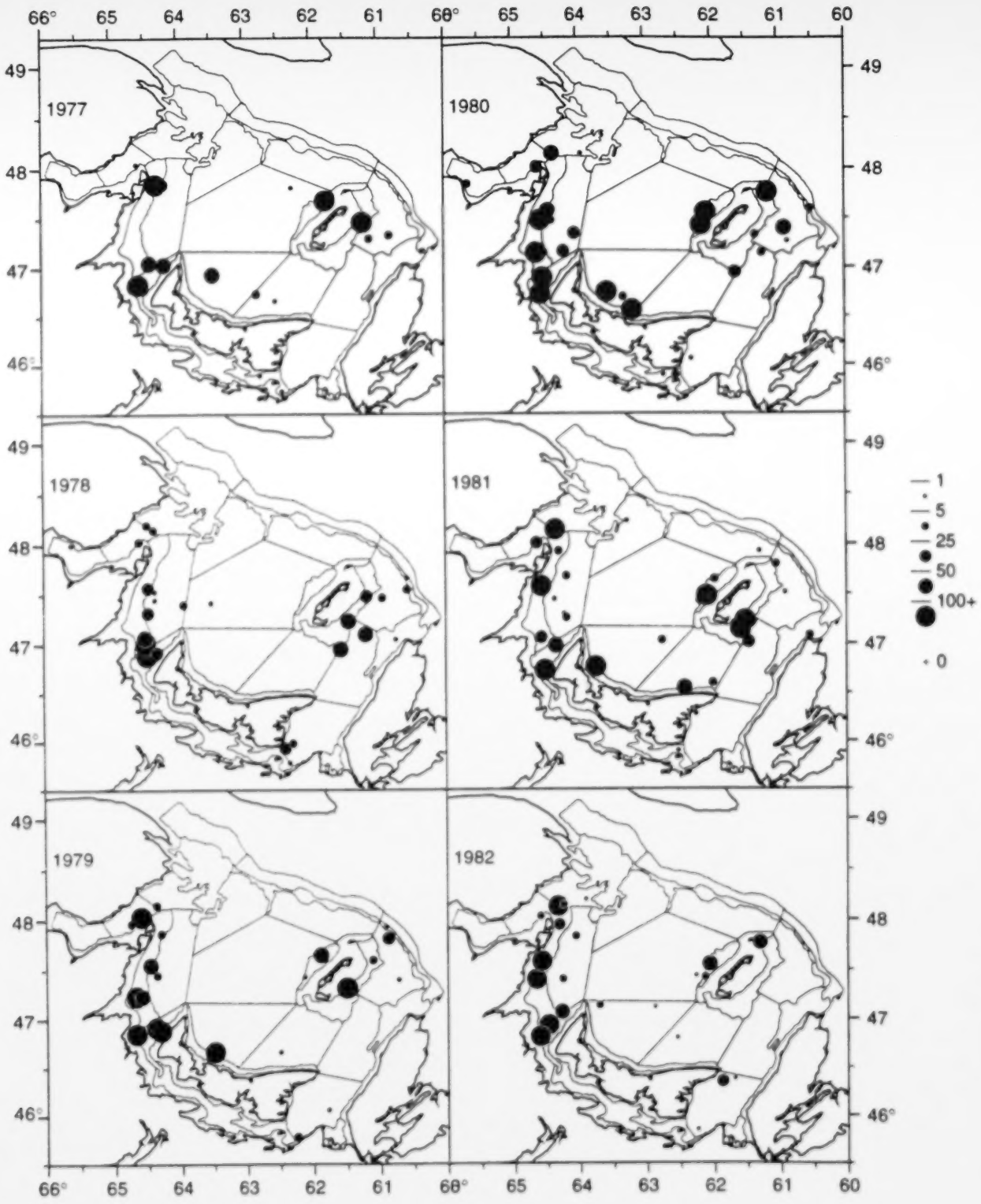


Figure 12 (cont'd). Location of yellowtail catches (numbers) during September surveys in the southern Gulf.

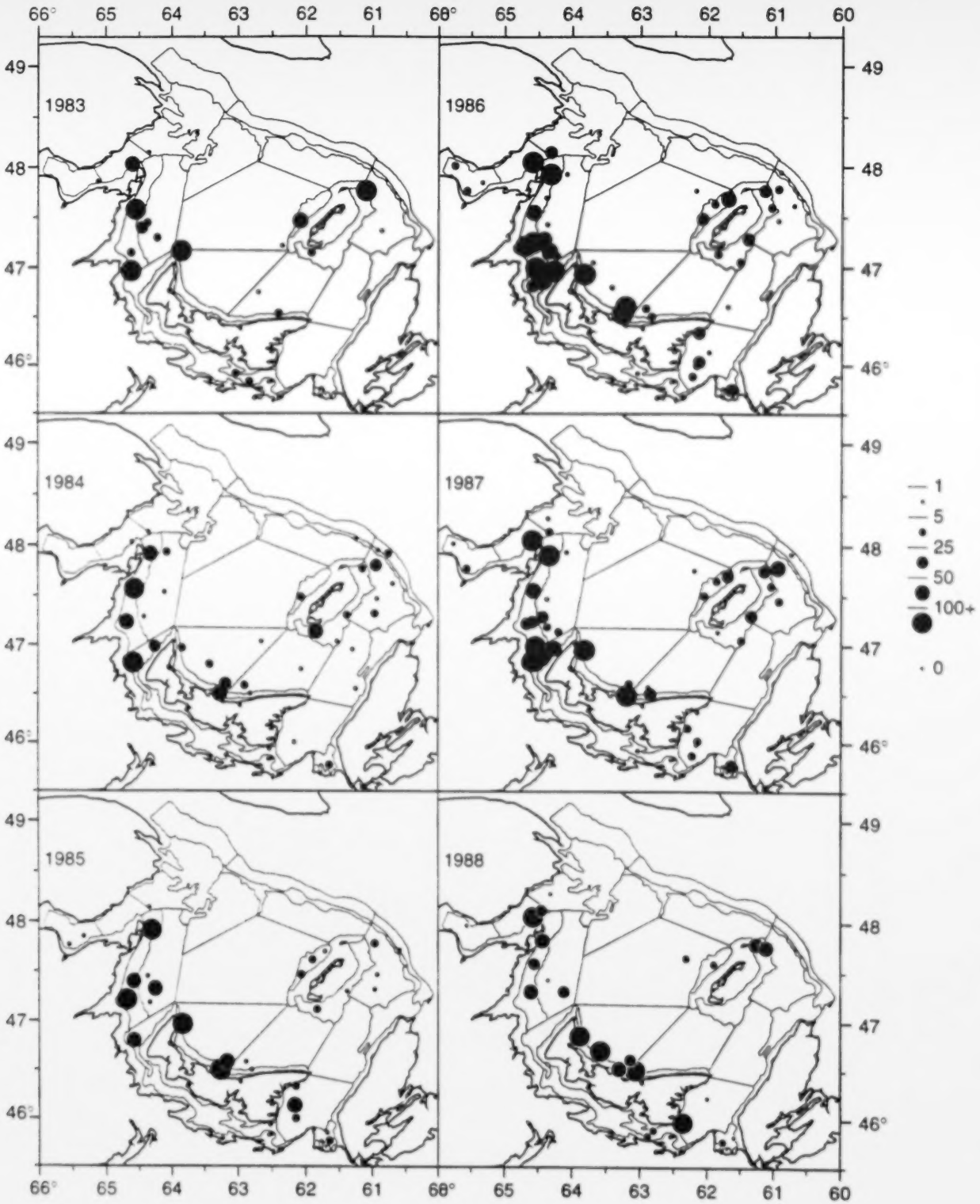


Figure 12 (cont'd). Location of yellowtail catches (numbers) during September surveys in the southern Gulf.

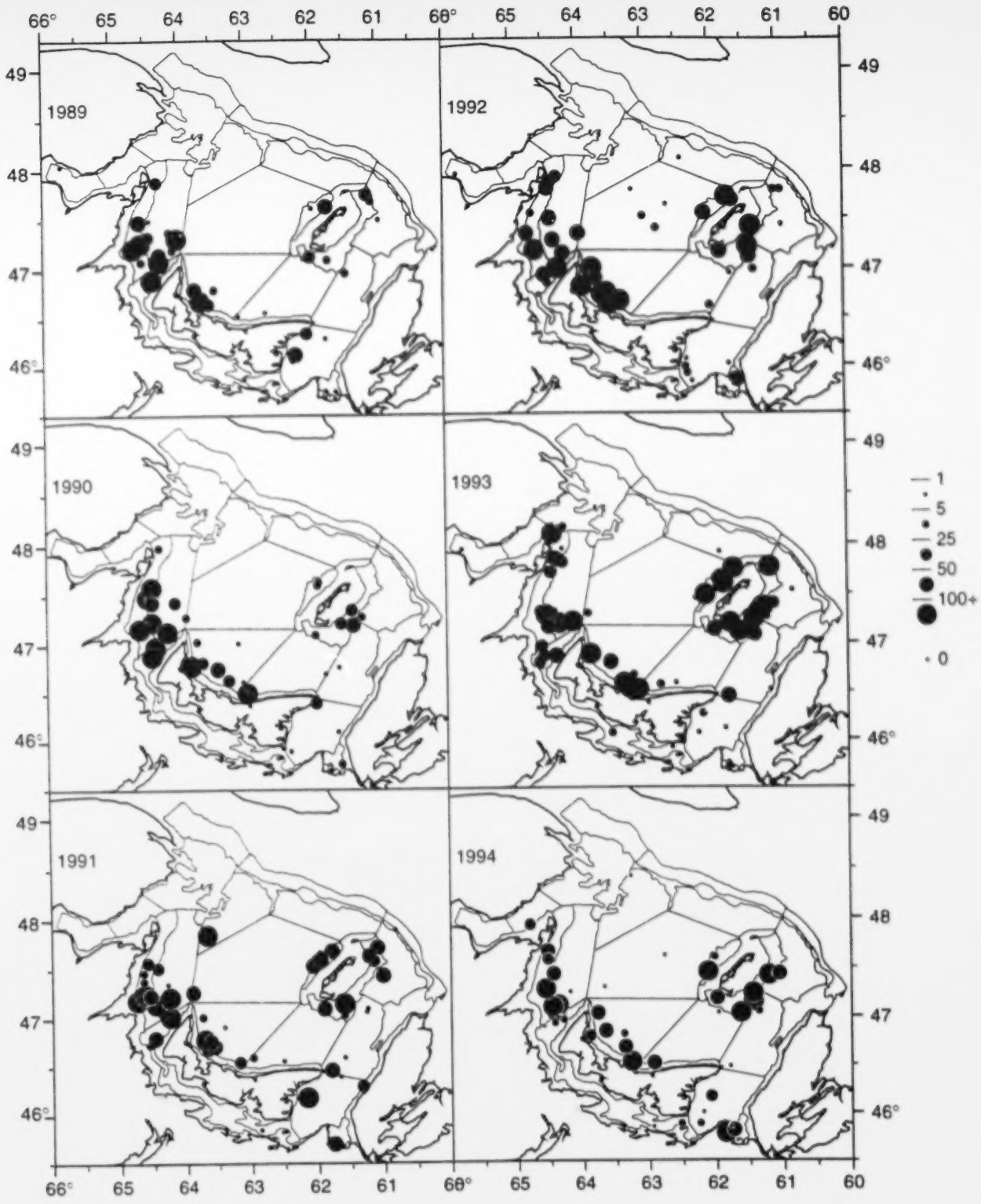


Figure 12 (cont'd). Location of yellowtail catches (numbers) during September surveys in the southern Gulf.

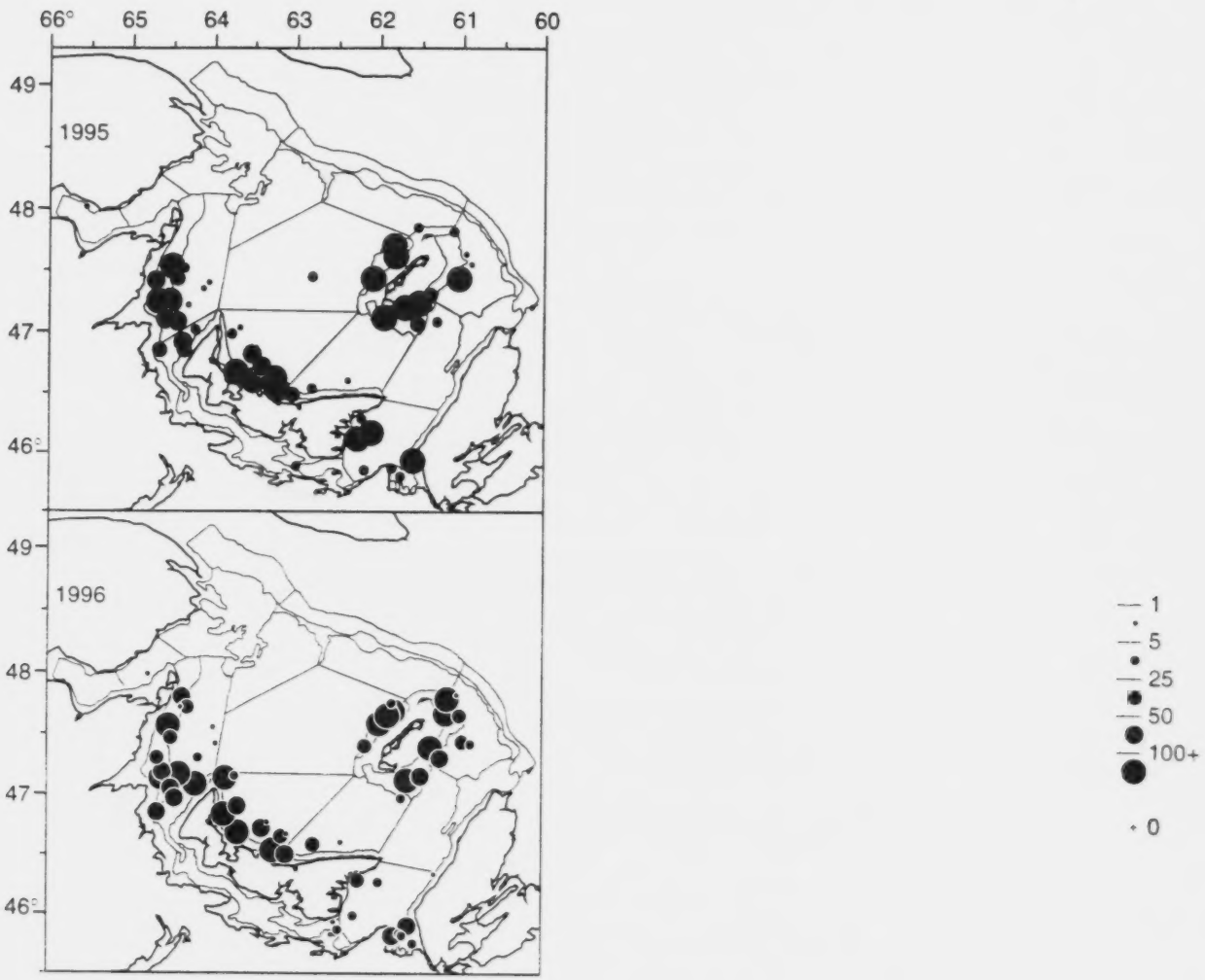


Figure 12 (cont'd). Location of yellowtail catches (numbers) during September surveys in the southern Gulf.

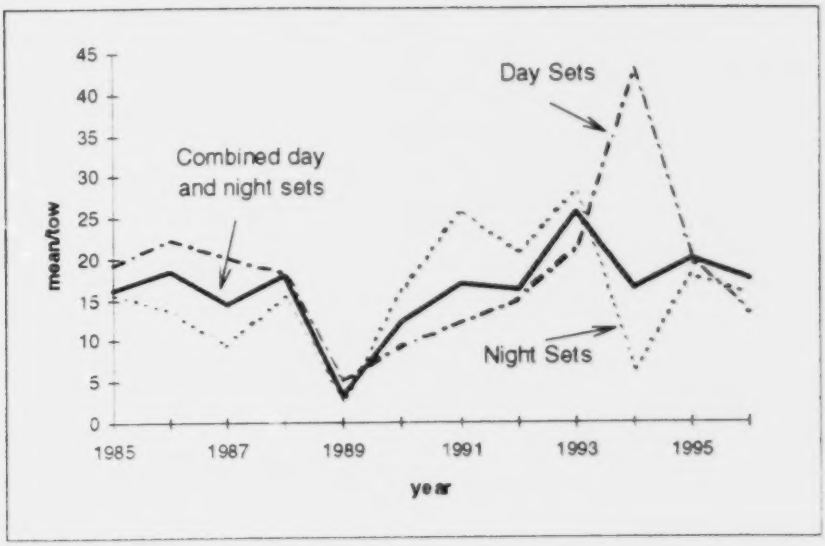


Figure 13. Mean number/tow for day and night sets using only strata surveyed in both time periods. Night catches are transformed to day equivalents.

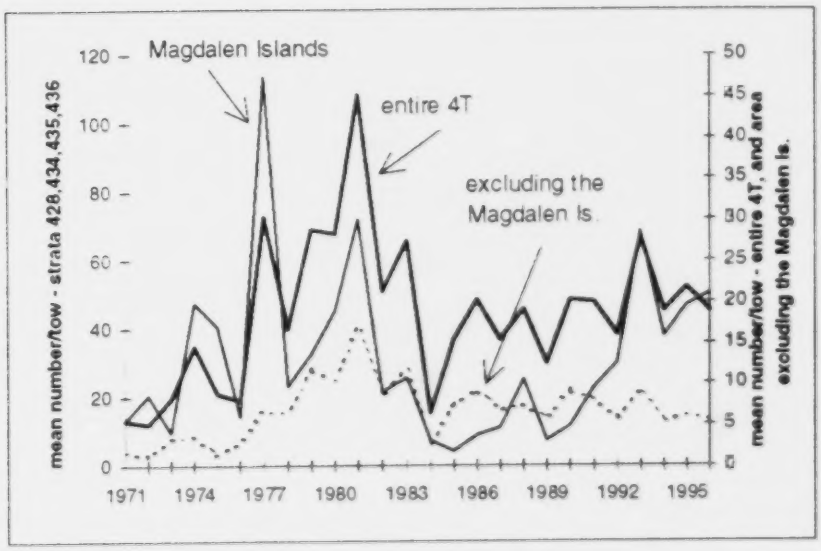


Figure 14. Mean number of yellowtail/tow in the 4T groundfish surveys - strata 428, 434, 435, and 436 surround the Magdalen Islands

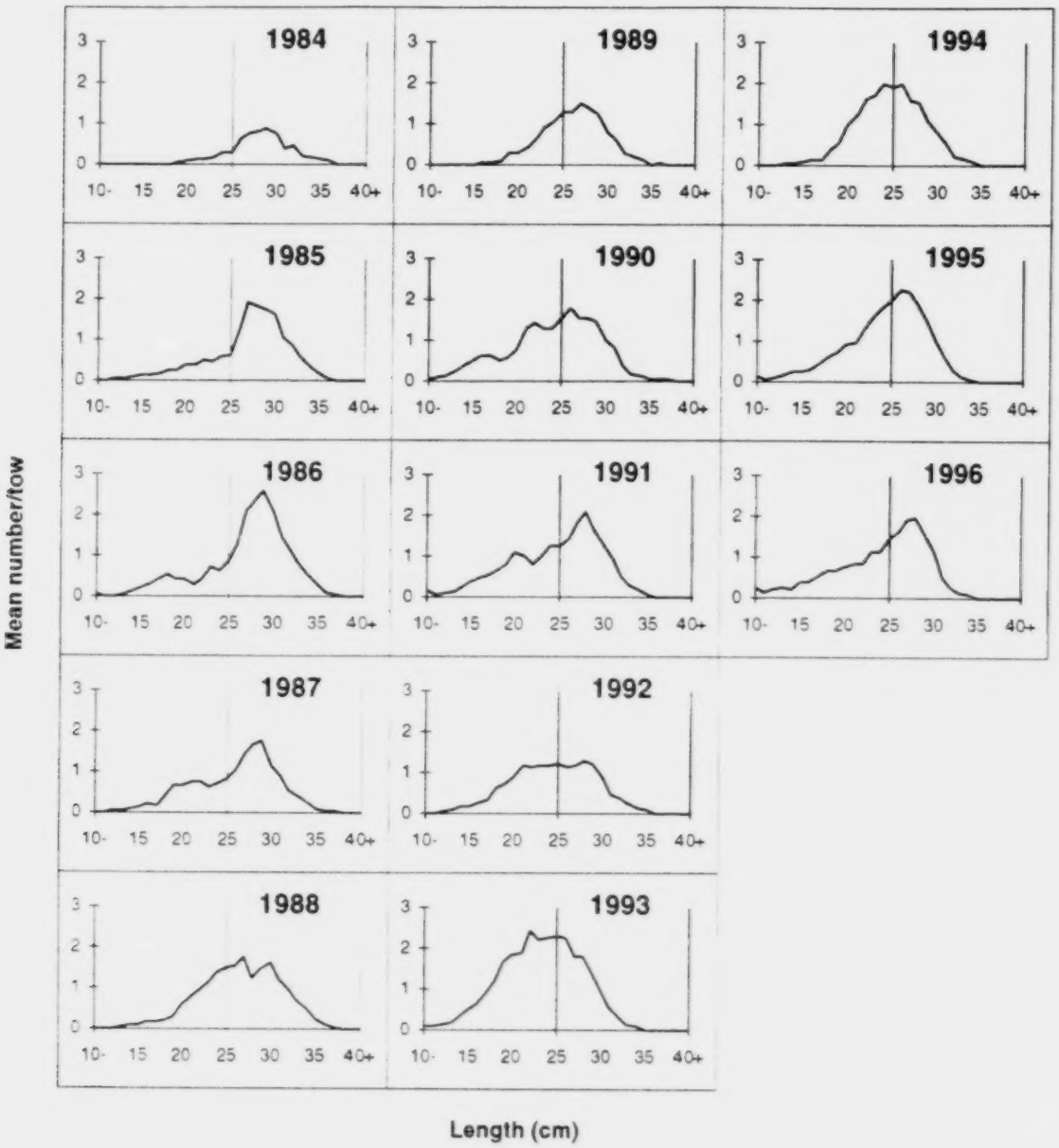


Figure 15. Annual length frequencies (mean numbers per tow) of southern Gulf of St. Lawrence yellowtail from September groundfish surveys, 1984-1996.

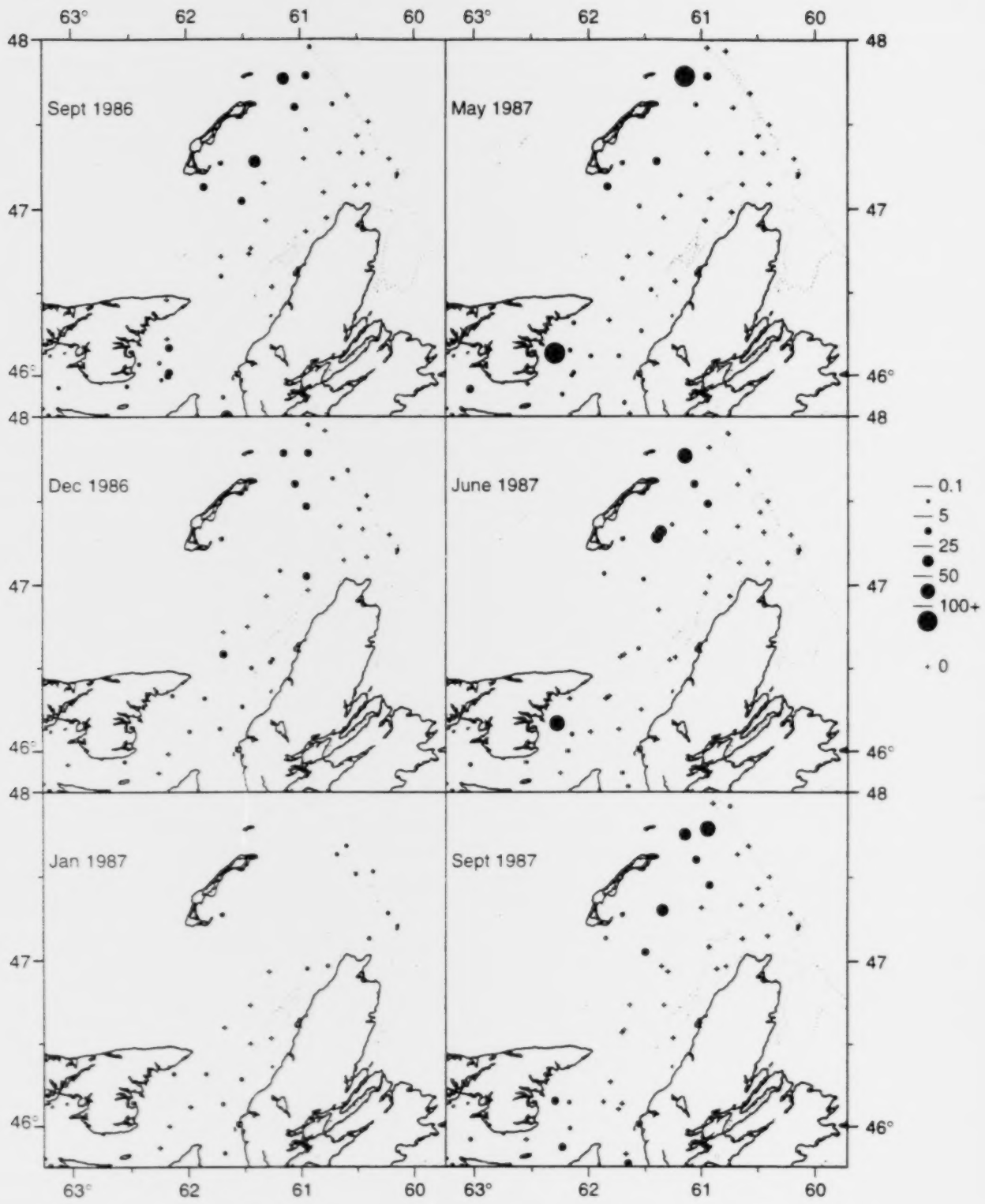


Figure 16. Distribution of yellowtail catches (numbers) in the 1986 and 1987 seasonal southern Gulf of St. Lawrence surveys - dotted lines indicate the 100 m and 200 m depth contours.

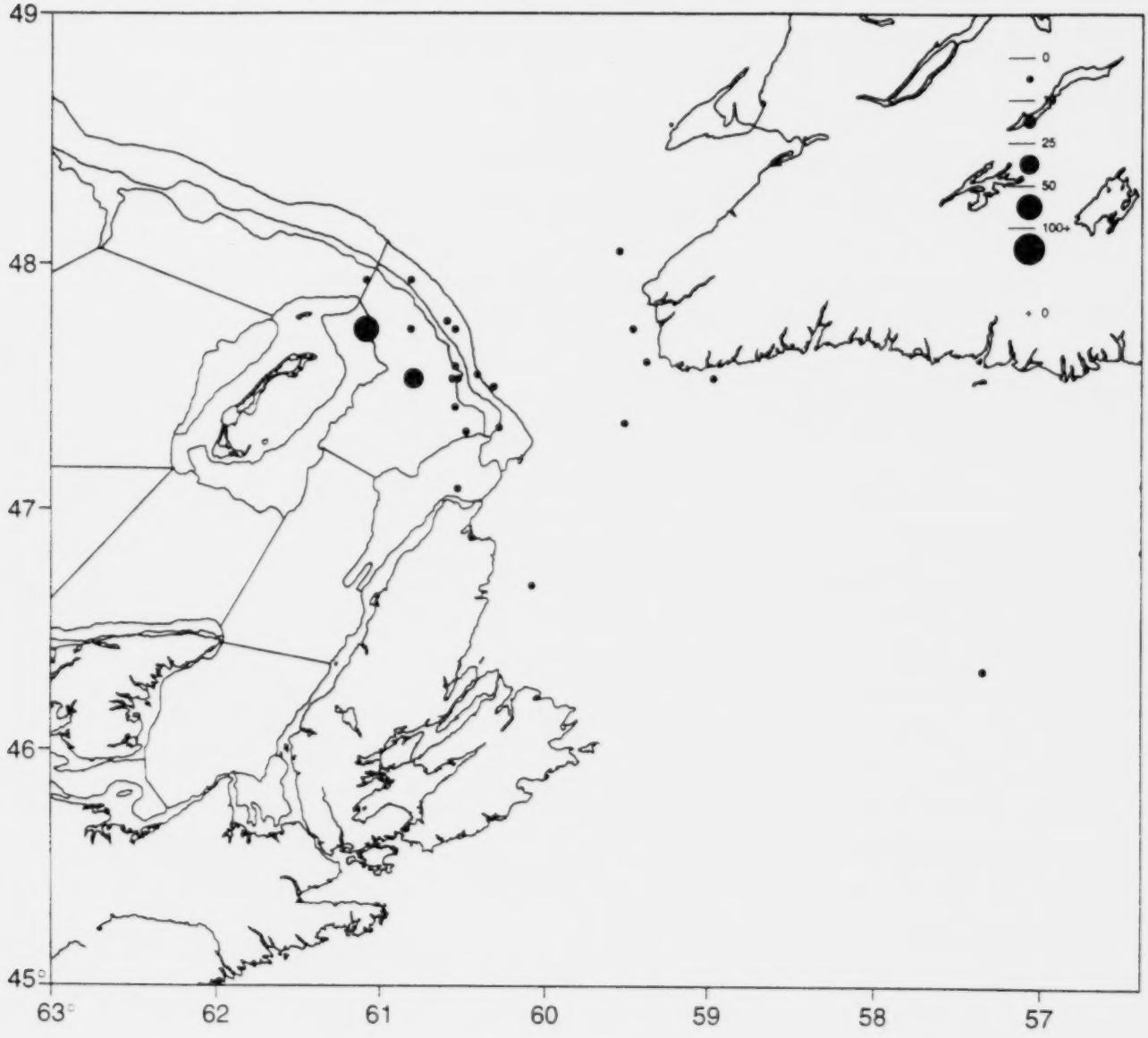
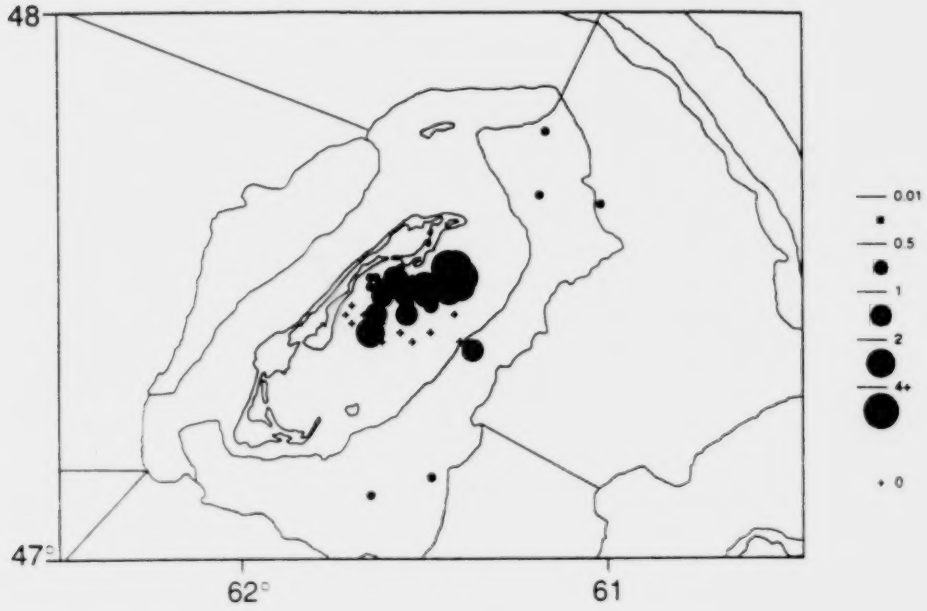


Figure 17. Yellowtail catches (numbers) in January surveys of the Cabot Strait - 1994-1997.



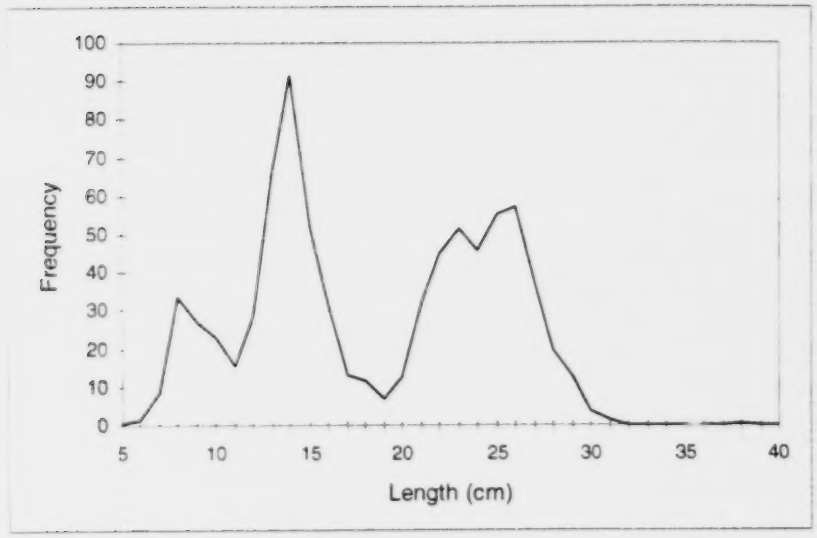


Figure 18. Distribution and length frequency of yellowtail catches in the 1996 *Calanus* survey. The distribution of yellowtail catches in the 1996 4T groundfish survey in stratum 435 are also shown.